

**KNIGHTSEN**  
**DRAINAGE IMPROVEMENT ASSESSMENT**

Prepared For

**CONTRA COSTA COUNTY  
PUBLIC WORKS DEPARTMENT**

**FINAL REPORT**

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## **BACKGROUND**

Knightsen is a mostly rural, agricultural area of eastern Contra Costa County that presently has only minor drainage improvements. These existing improvements generally consist of a few culverts under roads and railroad, and some roadside ditches with driveway culverts. Much of the normal storm runoff in the area percolates into the ground, or ponds in fields until the water dissipates. It is only during monthly periods with record rainfall that significant drainage problems occur. Knightsen has experienced severe flooding problems this winter during February, which had record amounts of rainfall. At the Brentwood rainfall station, 7.7 inches of rain was recorded during the month, which was about 400% of the normal rainfall for February, and was apparently the highest rain for that month out of 106 reports for February since 1880. Previous severe flooding problems occurred during the winter of 1982-83, which also had very high rainfall.

In addition to the flooding problems, which some residents experienced on a number of occasions in February, there are concerns about sanitary septic disposal systems which cannot function due to standing surface water and high groundwater, and possible contamination of drinking water well systems.

In order to alleviate the existing flooding problems, as well as the potential health safety problems, the Knightsen Flood Committee has examined the situation and put together a list of drainage improvement projects that would be designed to reduce many of the current drainage problems in Knightsen.

The scope of this report is to describe and make a preliminary evaluation of the feasibility of the proposed solutions.

To assist in this evaluation, background on the projects was provided by Seth Cockrell on February 25, and a field inspection of the flooded areas and the sites of the major proposed drainage improvements was made on February 26, with a followup inspection on March 10.

Available topographic maps were provided by the Contra Costa County Flood Control District, consisting of 1 inch to 100 feet scale maps with two foot contours, based on aerial photography dated August 19, 1970. Elevation information referred to in this report is based on these maps. Although these maps appear to still be generally accurate, because of the age of the maps, and possible changes that may have occurred to the area since they were prepared, additional survey may be required in some areas to confirm the feasibility of the projects.

This report does not attempt to estimate storm flows that would be expected in the area, determine the required size of proposed drainage facilities, or to estimate construction costs.

## **EXISTING DRAINAGE SYSTEM AND FLOODING PROBLEMS**

The existing drainage patterns in the area generally follow the existing ground slope, which has a gradual slope from the southwest towards the northeast. These patterns have been modified by

various improvements, including roads, railroads, levees, and irrigation canals. Drainage is hampered by the very flat ground slopes.

Figure 1 shows the project area and the location of existing and proposed features.

A complete delineation or review of drainage areas was not completed as part of this report. Based on available information, the areas which could drain into the central and eastern Knightsen area consists generally of the land east of Sellers Road, north of Sunset Road, and south of Delta Road. Some area west of Sellers Road and east of Marsh Creek, and some area south of Sunset Road also drains into this area through existing road culverts. Central Knightsen north of Delta Road also drains towards the south. Water from the south side of Sunset Road was observed crossing Sunset Road west of Sellers Road during some periods. Although during some historic floods in Knightsen, overflows from Marsh Creek contributed to flooding problems, the Marsh Creek channel has since been improved, and has not been a source of flood waters during the recent storms.

The following describes the location and properties of some of the existing drainage facilities. For all the culverts inspected, it appears that flow capacity would be controlled by outlet conditions in the ditch or location where the water is discharged.

Water from west of Sellers Avenue crosses this road in a 21-inch concrete pipe located north of Sunset Road. The discharge from this culvert does not enter a formal drainage channel, but spreads across the properties to the east of Sellers Avenue.

Water crosses Eden Plains Road in an 18-inch corrugated metal pipe located at the curve just south of the railroad tracks. This culvert has previously been erroneously reported as a 24-inch culvert. It was reported that water covered the west side of the road at this location, but did not overtop the road during the recent storms.

Water from south of Sunset Road crosses to the north through a 21-inch concrete pipe at S Cumming Road, west of Eden Plains Road.

Water from most of the central Knightsen area flows south across Delta Road in a 24-inch pipe just west of the railroad which is mostly submerged and partly blocked with sediment. Water continues south in a low capacity roadside ditch. At the embankment of the former Eden Plains Road crossing of the railroad, there are no drainage structures visible, so passage of water to the south may only occur during high flow conditions.

The Santa Fe railroad tracks form a barrier to drainage from the western part of Knightsen to east Knightsen. Most runoff from areas west of the tracks, including central Knightsen area, is forced to flow to the southeast. This water crosses the railroad track through a culvert just north of Sunset Road and west of Byron Highway. This culvert is a rectangular structure formed from wooden railroad ties, and measures about 38-inches high and 30-inches wide at the western, upstream side. The invert is about six feet below the top of the rails at the site. Farther to the southeast, there are two 24-inch corrugated metal pipes higher above the ground that would carry storm flow only during

very high water. There are no reports of water flowing through these latter culverts during the recent storms.

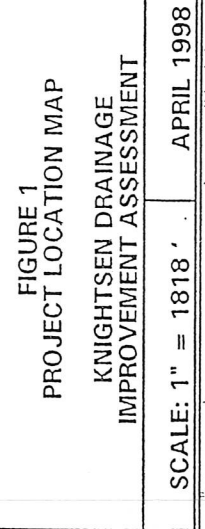
On the east side of the tracks, there is a ditch running parallel to the tracks that slopes towards the southeast. This ditch does not connect to any normal drainage facility, but ends in a natural low spot. Overflows from the ditch during recent storm periods flowed through the properties and access roads along the west side of Byron Highway. A roadside ditch on the west side of Byron Highway carries flows from north of Sunset Road to Delta Road. The south end of this ditch has been deepened for use as a tailwater irrigation facility, with some standing water during periods without rainfall.

At Delta Road and Byron Highway, a 22 by 13-inch corrugated metal pipe arch culvert (approximately equivalent to a 18-inch pipe) carries flow from the west side to the east side of Byron Highway. At the time of the initial inspection, both the entrance and exit of the culvert were submerged. This culvert has a concrete headwall, with the pipe invert about 24 inches below the top of the headwall. East of Byron Highway, a roadside ditch carries flow towards the east along the south side of Delta Road. At the approximate boundary of the Veale Tract, just east of the power transmission lines, the ditch currently ends. It is reported that historically, flow continued east at this location, or was carried to the north across Delta Road in a culvert. At the present time, the Veale Tract (Reclamation District 2065) claims that it is not obligated to accept or drain any flood waters from properties that are not in the assessment boundaries of the district. During the recent storms, overflows to the north side of Delta Road occurred, and the property owner on the south side of Delta Road (Ivan Cerries) eventually allowed water into his property, and this water flowed south towards the No Name Slough. Temporary pumps were installed at the slough to remove the drainage water, and the property owner performed grading work to improve the drainage ditches on his property.

Near central Knightsen, there is a low spot at the intersection of Delta Road and Curlew Connex which does not have any natural outlet. Water accumulated at this location and completely covered the road during the recent storms, and threatened two houses near the intersection. At the time of the field inspection, water was up to four inches deep at the middle of the road, and covered the road for several hundred feet.

The canals of the Eastern Contra Costa Irrigation District (ECCID) are not intended to provide drainage in the area. However, some fields, either due to natural slopes or due to regrading done to facilitate irrigation, slope towards the canals. During high runoff periods, water may pond at the end of these fields and may spill into the canals. There are reports and/or videos of overflows at two rectangular standpipe structures near Eden Plains Road and the railroad, one on each side of the railroad. The duration of overflow and its possible contribution to flooding problems in the area is not known. There are also reports that some pumping of water from fields into the canals may have occurred, causing or contributing to the observed spills.

Although there were many parts of Knightsen which had drainage problems during the recent storms, the area which was most affected by flooding was the area called the "Knightsen Triangle" (east of the Santa Fe railroad, south of Delta Road, and west of Byron Highway). This area received water



from west of the railroad tracks which spread across properties and along roads towards the northeast. Water also overtopped Byron Highway south of Delta Road.

For drainage planning purposes, the area contributing flows to this flooded area can be evaluated as two areas -- the area east of the railroad and the area west of the railroad.

The drainage area east of the railroad in the Knightsen Triangle is about 430 acres, (0.7 square miles). The drainage area west of the railroad tracks, while not exactly determined, is probably at least 820 acres (1.3 square miles) if all areas are contributing runoff, and ignoring possible flows into or out of the area in irrigation canals.

## **PREVIOUS DRAINAGE STUDIES**

A drainage study was previously conducted in 1984 for the Contra Costa County Flood Control District for east Knightsen. This study proposed two basic alternative solutions for drainage improvements in the Knightsen area.

Both alternatives assumed that flow from west of the railroad tracks would be carried to No Name Slough through the future Eden Plains Channel (no flows or dimensions of the channel were provided).

Alternative A had runoff from areas west of Byron Highway flowing by gravity towards the north into Rock Slough, with a detention area to provide some storage and a pump station to lift water into the slough. Some concerns were raised about possible contamination of water in the Contra Costa Canal, which obtains water from this slough.

Alternative B had water flowing by gravity or pumped to the south into a channel that would flow into No Name Slough.

The drainage improvements proposed in this study were apparently rejected by the local residents due to the high cost.

## **PROPOSED DRAINAGE IMPROVEMENTS**

A series of projects have been put together by the Knightsen Flood Committee that they felt would provide solutions to most of the drainage problems currently being experienced in Knightsen.

The proposed solutions appear to be based on a practical knowledge of the drainage conditions of the area, and for the most part appear to be technically feasible. However, questions remain to be resolved about property rights of way, financing, and continued maintenance of the proposed facilities. It is envisioned that many of the improvements would be provided through local community resources.

The location of these proposed projects is shown in Figure 1, and the projects are described and discussed here:



### **Project 1      Delta Road from Byron Highway to Veale Tract and No Name Slough**

This project would divert the water from the existing Delta Road ditch, and bring it south across Ivan Ceries's property to No Name Slough. Water would be pumped into the slough from the location of the existing 5 hp pump at the southeast corner of the property, in order to utilize the existing electric service. It is proposed to obtain a 20 hp pump for this location. A siphon discharge line for this pump would allow gravity assisted discharge under low tide conditions.

The ditch along Delta Road from Byron Highway (a length of about 4000 feet) would be deepened and widened to provide more flow capacity. Existing driveway culverts along Delta Road (about 14) may have to be replaced, and the culvert across Byron Highway at Delta Road would be replaced with a larger structure or with an additional parallel structure.

This project appears to be a reasonable means of providing drainage benefits to the area that has been most affected by flooding problems, by providing additional flow capacity away from the area.

### **Project 2      Byron Highway South of Delta Road**

This project would improve the existing highway ditch on the west side of Byron Highway which flows north to Delta Road. Water would also be pumped from the south end of the ditch (at the site of an abandoned irrigation pump) to Richardson Drain, which extends from just east of Byron Highway to No Name Slough, and is owned and maintained by ECCID.

The pumping portion of this project would be intended as a temporary measure until project number 3 would provide gravity drainage along roughly the same route. During the field inspection, there were discussions concerning the best configuration for the proposed pumping. It was felt that a better option may be to pump from the existing low area next to the railroad tracks, with the possibility of enlarging this sump area. The option of pumping into a nearby ECCID irrigation lateral was also explored. ECCID gave a preliminary indication that pumping water into this lateral (probably a 16-inch pipe) may be possible. Although the drain water would have to run backwards (uphill) on this line, the standpipe should be high enough to accomplish this. Drainage water would flow south and across Byron Highway to the Richardson Drain.

The amount of water that could be pumped in this manner would probably not be enough to eliminate flooding problems in the area along Byron Highway during the most severe storms. Depending on the volume available for storage in the sump area, this option could provide benefits to downstream areas during a series of storms.

### **Project 3      Railroad to Richardson Drain**

This project would consist of a canal or ditch from the existing culvert crossing the railroad, along the railroad to the old Sunset Road crossing, and east across Byron Highway to the existing Richardson Drain along Eagle Lane.

Based on available maps, and approximate field estimates, the invert of the railroad culvert is probably around elevation 16 feet, and the ground farther southeast along the railroad tracks rises to about elevation 25 feet. Therefore, a cut of about 10 feet would be required for this ditch at the deepest point, and the ditch might have to be 30 feet wide. It appears that the outlet at the Richardson Drain (or a parallel ditch, if required), would be low enough to allow gravity flow from the railroad culvert. The existing drain is an earth ditch, about 3 to 4 feet deep, with a top width of about 10 feet.

The 1985 drainage study shows a route for a drainage channel that would go east to Byron Highway at a location north of where the ground rises, then southeast to the Richardson Drain area. This route may be a more economical alignment for this drainage channel than along the railroad, due to the shallower earth cut and width of ditch required. It might also allow some high flows from the ditch on the west side of Byron Highway to flow towards the south into this channel. Culvert pipes for portions of the route might also be considered, which may involve higher costs but would allow less disturbance of existing areas.

This project would provide benefits by diverting upstream inflows away from the area with the most problems, and would allow gravity flow of water which would reduce pumping and maintenance costs lower in the drainage system at project 1, and allow smaller drainage facilities for projects 1 and 2.

#### **Project 4      South of Delta Road to Railroad**

This project would provide drainage from the back of Bob Pastor's property on Delta Road south to the railroad tracks, where the flows could enter the Project 3 drainage channel.

Available topographic maps indicate that the ground may have a slight rise along this route, and gravity flow may be difficult. Further surveys in this area may be required to determine if the project is feasible.

The site was not inspected during the field survey.

#### **Project 5      Eden Plains Road to Railroad**

This project would provide additional drainage capacity from the 18-inch culvert under Eden Plains Road near the railroad, southeast along the railroad to the existing culvert under the railroad.

This project would follow the path of the existing drainage in this area. The primary benefit would be to provide better drainage from areas west of Eden Plains Road, including probably the area of central Knightsen, which drains along the northeast side of Knightsen Avenue. Improving the drainage channel in this area might increase flows through the existing culvert under the railroad, so care would have to be taken in planning downstream drainage facilities.

#### **Project 6      Curlew Connex at Delta Road**

This project would provide pumping of flows from the depression on Delta Road at Curlew Connex which has no natural surface drainage outlet.



The initial proposal was for pumping of flows into a ditch in the field south of Delta Road, which would drain to the culvert at Eden Plains Road. Additional investigations were made into the possibility of utilizing ECCID facilities for drainage purposes. It was found that an irrigation standpipe located at the flooded intersection could not be utilized for drainage purposes. A better solution was felt to be pumping of water into an ECCID canal about one half mile south of the intersection. This solution is currently being utilized for draining the intersection through the use of irrigation piping. A more permanent solution may be the installation of underground pipe along this route, which would expedite the pumping of water from the area when flooding does occur.

**Project 7      Ranch Road to Railroad**

This project would provide a drainage ditch from the end of Ranch Lane (off of Eden Plains Road) north to the railroad tracks. It would provide better drainage for the properties south of Ranch Lane. Some of these properties have areas with no natural outlet, and some pumping might have to be provided by property owners.

This project appears to be located along the path of a drain shown on available maps.

**Project 8      Eden Plains Road to Byron Highway**

This project would consist of a ditch from Eden Plains Road east to Byron Highway, and would provide improved drainage for the properties in this area.

**Project 9      East Cypress Road at Jersey Island Road and East Cypress at Broadway**

This is an area with existing drainage problems. No specific solution is presently provided, as it would have to be worked out with Reclamation District 799 in this area.

**Project 10    Tule Lane to Rock Slough**

This project would provide a ditch or pipeline in from Fireplace Road along Tule Lane to Rock Slough. This would provide drainage benefits to properties in this area.

**Project 11    Moller Property to Veale Tract**

This project would provide a ditch or canal from the Moller property to the Veale Tract (Reclamation District 2065).

**Project 12    Railroad to Orwood Road**

This project would provide a ditch along the west side of the railroad from the east side of Byron Highway south to Orwood Road. An existing culvert 1920 feet east of Byron Highway would be blocked. Flows would be pumped at Orwood Road into an existing ditch.

The project would provide better drainage to the properties in this area, as well as properties on the east side of the railroad, which currently receive water from the railroad culvert.

## CONCLUSIONS AND RECOMMENDATIONS

The flooding problem in the area of the Knightsen Triangle, where the worst flooding occurred, could be considerably reduced by diverting the flow which enters this area from west of the railroad. As discussed previously, perhaps as much as two thirds and possibly more of the flow at the flooded area may have originated from west of the railroad. Drainage improvements such as project 3, which would carry runoff into No Name Slough with a gravity ditch, would provide benefits by keeping this water away from the problem area. These improvements would also reduce the required size of drainage improvements along Byron Highway and Delta Road, and reduce requirements for pumping water at downstream locations.

Drainage improvements in the area of the existing culvert at Delta Road and Byron Highway, and the ditch and driveway culverts going east on Delta Road, such as proposed in project 1, would provide benefits by allowing easier passage of water away from the flooded area. However, it is not certain that project 1 by itself could have prevented flooding from the storms which occurred during February.

With the limited scope of this report, the flows and required size of drainage components have not been determined. Therefore, it is not known how much additional flow capacity could reasonably be provided along Delta Road at the site of project 1. It may not be practical to have a drainage facility at this location that is sized to carry flows from the estimated 1250 acres that may contribute water to this area during severe storms. The area south of the road presently has about a ten foot wide space from the existing edge of pavement. Improvements wider than this may encroach on existing walls, fences, and utility poles, which may not be feasible or may substantially increase the cost of drainage improvements. It is not known how far the road right-of-way extends. Also, an expanded and deepened ditch alongside the road with little or no shoulder area may present increased safety hazards to drivers.

Projects 1 and 3 will probably provide the most benefits in reducing the worst of the flooding problems in the Knightsen area. Based on available information, it is recommended that a project such as project 3 be considered as the highest priority for solving the major flooding problems of the area, with project 1 considered for possible additional benefits. Most of the other projects should provide benefits in mitigating other localized drainage problems.

In considering implementation requirements for the major projects, most of the drainage improvements for project 1 would be located on existing road rights-of-way. The disposition of water draining east on Delta Road will have to be resolved. Carrying this water north into Rock Slough (source of the Contra Costa Canal), or east into the Veale Tract may not be feasible. Draining to the south into No Name Slough appears feasible, although property easements would have to be obtained. It would not be desirable to implement project 1 until the downstream disposition of the drainage water is determined.

Project 3 would require obtaining property easements for most areas of the improvements, and possible cooperation with the East Contra Costa Irrigation District for joint use of the Richardson Drain.

For immediate relief of possible flooding problems during the remainder of the winter, there are few of the projects which could be constructed without obtaining permanent property rights agreements, which would be difficult to obtain on short notice. Pumping from Curlew Connex and Delta Road (project site 6) is currently being done on a temporary basis. It appears that pumping from east of the railroad culvert (near project site 3) or from the south end of the Byron Highway ditch (project site 2) into ECCID irrigation facilities could be readily accomplished, and would provide some benefits to properties in the Knightsen Triangle area, but would be unlikely to completely eliminate flooding problems if further major storms occur. This pumping would still require access onto private property, but should not have any long term impact on the sites.